Analysis of Earthquake Data from the Greater Los Angeles Basin and Adjacent Offshore Area, Southern California

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Element I & III

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SUMMARY

The goals of this project are to provide seismotectonic synthesis of earthquake data recorded by the CIT/USGS Southern California Seismic Network, including TriNet, and Anza seismic networks during the last 20 years in southern California. In addition we are improving models of the velocity structure to obtain more accurate earthquake locations including depth and to determine focal mechanisms. We also perform studies of the earthquake potential and the detailed patterns of faulting along major faults in the greater Los Angeles metropolitan area and adjacent regions.

RESULTS

Three-Dimensional *Vp* and *Vp/Vs* Velocity Models of Southern California

New three-dimensional (3-D) V_P and V_P/V_S models are determined for southern California using P and S-P travel times from local earthquakes and shots (Figure 1). These models confirm existing tectonic interpretations and provide new insights into configuration of the geological structures along the Pacific North America plate boundary. The models extend from the US-Mexico border in the south to the Coast Ranges and Sierra Nevada in the north, and have 15 km horizontal grid spacing and an average vertical grid spacing of 4 km, down to 22 km depth. To illustrate how the model features vary within and between geological terranes, we analyze maps and cross sections of interpolated velocity variations and velocity depth profiles for the average velocities within individual terranes. The heterogeneity of the crustal structure as imaged in both the V_P and V_P/V_S models is larger within the Pacific than the North America plate reflecting regional asymmetric variations in the crustal composition and past tectonic processes. Similarly, the relocated seismicity is deeper and shows more complex 3-D distribution in areas exhibiting compressional tectonics within the Pacific plate. The V_P values are 0.2 to 0.4 km/s too high to support an abundant occurrence of schist beneath the Mojave Desert and the San Gabriel Mountains. The models reflect mapped changes, from east to west, in the lithology of the Peninsular Ranges. The interface between the shallow Moho of the Continental Borderland and the deep Moho of the continent forms a broad zone to the north beneath the western Transverse Ranges, Ventura basin and the Los Angles Basin and a narrow zone to the south, along the Peninsular Ranges. When comparing individual terranes, the shape of the near surface gradient and the amplitude of the Conrad discontinuity vary. The shape of the near-surface gradient that in most cases

exists from the surface to 6 or 8 km depth and in rare cases extends down to 15 km depth is different for stable blocks, mountain ranges, and sedimentary basins. The shape and topography of the Conrad discontinuity, at approximately 16 km depth, also varies between terranes, with no Conrad discontinuity being present beneath some mountain ranges while being prominent beneath most of the large sedimentary basins. These results have been published in Journal of Geophysical Research by Hauksson (2000).

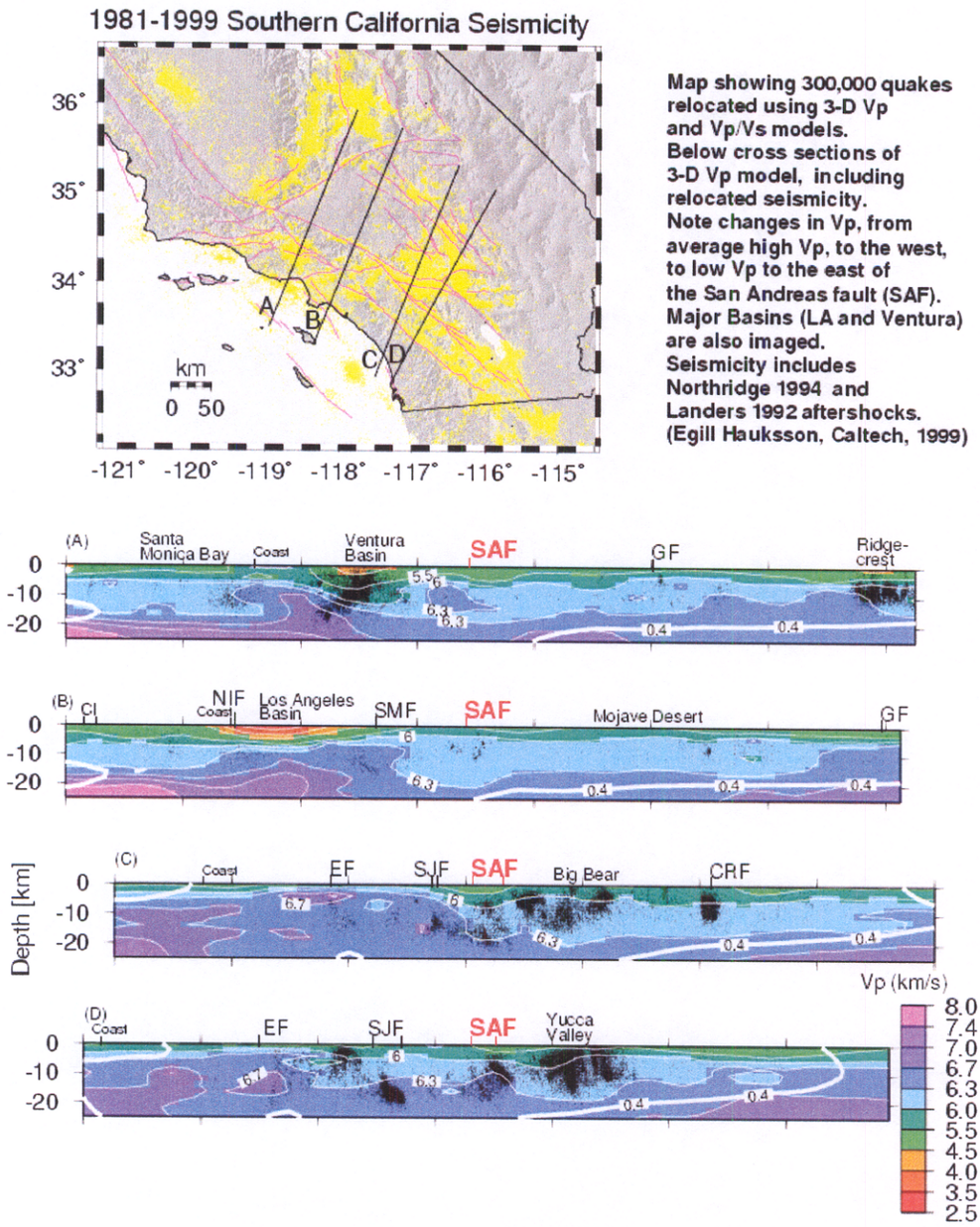

Figure 1. Cross sections of Vp model and relocated seismicity, from Hauksson (2000).